

eRD21

EIC Background Studies and the Impact on the Interaction Region and Detector Design

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1 Accomplishments to Date

- Comprehensive simulations of proton-residual-gas interactions and hadronic cascade in a realistic model of the EIC Interaction Region (IR) from 100 GeV to sub eV scale in FLUKA framework. The equivalent 1 MeV neutron flux produced at full proton current does not pose a significant threat to the lifetime of key detector components.
- Simulation of full hadronic cascades from physics ep collisions at the Interaction Point (IP).
- Studies of synchrotron radiation and impact on the Si Vertex Tracker (SVT). The current status of these simulations shows unacceptably high rates in the SVT. However, we are in the process of implementing key mitigation elements of the EIC Project design of the electron beam line.

2 Assessment of Technological Readiness

The tools for background simulations are in place.

3 Assessment of work remaining for a TDR

- Following the Call for Detector Proposals, and a preliminary down-select, the simulation model should be upgraded to provide a more detailed description of the proposed detector(s).
- Molecular dynamics calculations of the IR vacuum are required. This has started, but is dependent on the finalizing the synchrotron radiation flux into the beam pipe throughout the IR. The beam vacuum must also be simulated for various pumping configurations.

4 Cost Estimate and Timeline

Continuing the hadronic cascade and synchrotron radiation studies requires at a minimum funding for one 50% FTE post-doc on each topic. This is a cost of \$135,000/yr. To follow the iterations on the detector design, and satisfy the requirements for a Technical Design Report, this funding will likely be required for two years.